

What is claimed is:

1. A microfluidic device, including:
  - an input port for receiving a particle-containing liquidic sample;
  - 5 a retention member in communication with the input port and configured to spatially separate particles of the particle-containing liquidic sample from a first portion of the liquid of the particle containing fluidic sample; and
  - a pressure actuator configured to recombine at least some of the separated particles with a subset of the first portion of the liquid separated from the particles.
- 10 2. The microfluidic device of claim 1, wherein the pressure actuator is configured to reduce a gas pressure inside the device and in communication with the particles.
3. The microfluidic device of claim 1, wherein a ratio of a volume of the subset of the first portion of liquid to the first portion of fluid is at least 1%.
4. The microfluidic device of claim 1, wherein a ratio of a volume of the subset of the  
15 first portion of liquid to the first portion of liquid is less than 25%.
5. The microfluidic device of claim 1, wherein the retention member is a filter.
6. The microfluidic device of claim 1, wherein the device includes a reservoir configured to receive at least some of the first portion of the liquid, and wherein a pressure within the reservoir increases upon receiving the first portion of liquid.
- 20 7. A method for processing a particle-containing liquidic sample, including:
  - inputting a particle-containing liquidic sample into a microliquidic device including a retention member including a first surface;
  - spatially separating a first portion of the liquid of the liquidic sample from particles of the liquidic sample by passing the first portion of the liquid through at least the first surface of  
25 the retention member; and
  - recombining the retained particles with a subset of the first portion of the liquid.
8. The method of claim 8, wherein recombining the retained particles includes reducing a pressure within the microfluidic device.

9. A microfluidic device for processing a particle-containing liquid sample, including:  
an enrichment region, including:

a retention member configured so that liquid of a particle-containing liquid sample received therein exits the enrichment region along an exit path including a first surface of the retention member and particles of the particle-containing liquid sample are retained by the retention member; and

a pressure actuator configured to introduce fluid into the enrichment region along an entry path including the first surface of the retention member.

10. A method for enriching a sample, including:

introducing a particle-containing fluidic sample to a microfluidic network;  
applying a pressure to the fluidic sample to expel a first amount of the fluid of the fluidic sample through a filter configured to retain particles of the fluidic sample within the microfluidic network; and

subjecting retained particles of the fluidic sample to a reduced pressure to cause a second, smaller amount of fluid to enter the microfluidic network through the filter and entrain the particles to form an enriched particle-containing sample.

11. The method of claim 10, wherein applying a pressure includes mating a syringe to an input port of the microfluidic network.

12. The method of claim 11, wherein the step of introducing the particle-containing fluidic sample also applies the pressure to expel the first amount of fluid.

13. The method of claim 12, wherein subjecting the particles of the fluidic sample to a reduced pressure includes creating a vacuum within the microfluidic network and placing the vacuum in communication with the retained particles.

14. A device for concentrating particles of a particle-containing fluid, including:  
a substantially planar substrate including a microfluidic network; and  
a mechanically actuated vacuum generator integral with the substrate, the vacuum generator including an expandable chamber in fluidic communication with the microfluidic network.

15. A device for concentrating particles of a particle containing fluid, including:  
a first substrate and a second substrate, the first and second substrates defining therebetween:

at least a portion of a microfluidic network, the microfluidic network

including a first end and a second end, the first end configured to receive a sample including a particle-containing fluid;

a chamber, the second end of the microfluidic network being in fluidic communication with the chamber;

5. a manually actuated member operatively associated with the chamber and configured, upon actuation, to increase a volume thereof, whereupon, a pressure within the chamber decreases drawing fluid toward the second end of the microfluidic network.

16. A method for enriching a particle-containing fluidic sample, including:

- 10 contacting a particle-containing fluidic sample with a filter so that a first portion of the fluid of the PCFS passes through the filter and particles of the PCFS are retained by the filter, the fluid passing through the filter entering a chamber and increasing a pressure therein; and allowing a second, smaller portion of the fluid to pass back through the filter and recombine with the particles retained by the filter.

17. A microfluidic device, comprising:

- 15 a first planar substrate comprising first and second sides;  
a second substrate mated to the first side of the first planar substrate;  
a third substrate mated to the second side of the first planar substrate;  
wherein, the first side of the first planar substrate and the second substrate define therebetween:  
20 a channel configured to accommodate microfluidic samples; and  
an amount of thermally responsive substance (TRS) disposed adjacent the channel, the TRS having a stationary state at a first temperature and a movable state at a second, higher temperature; and  
the second side of the first planar substrate and the second substrate define  
25 therebetween a chamber in gaseous communication with the TRS.

18. A microfluidic device, comprising:

- a lysing chamber having a volume of less than 10 microliters;  
an upstream channel leading to the lysing chamber and a downstream channel extending from the lysing chamber;  
30 a mass of a temperature responsive substance (TRS) disposed in the downstream channel, the mass of TRS configured (a) to inhibit downstream passage of material when material is introduced to the lysing chamber and (b) to pass downstream upon being heated to allow downstream passage of material from the lysing chamber.

19. A method for lysing cells of a cell-containing sample, comprising:

introducing the cell-containing sample to a lysing chamber of a microfluidic device, a downstream channel extending downstream from the lysing chamber, the lysing chamber having a volume of less than 10 microliters, a mass of a temperature responsive substance (TRS)

5 disposed in the downstream from the lysing chamber inhibiting downstream passage of the the sample from the lysing chamber;

heating cells within the lysing chamber to a temperature sufficient to release intracellular material; and

heating the TRS, whereupon the TRS and intracellular material pass downstream.

10 20. A method for processing a sample, comprising:

introducing a sample to a microfluidic network of a microfluidic device, wherein the introduction generates a gas pressure within a reservoir in communication with the microfluidic network;

storing the pressure within the reservoir; and then

15 using the gas pressure to move the sample within the microfluidic network.

21. The method of claim 20, wherein using the gas pressure comprises heating a temperature responsive substance within the microfluidic device.